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# AGRICULTURAL Research

May 1959

## THE GRANULAR CARD SAVES COTTON

Page 6

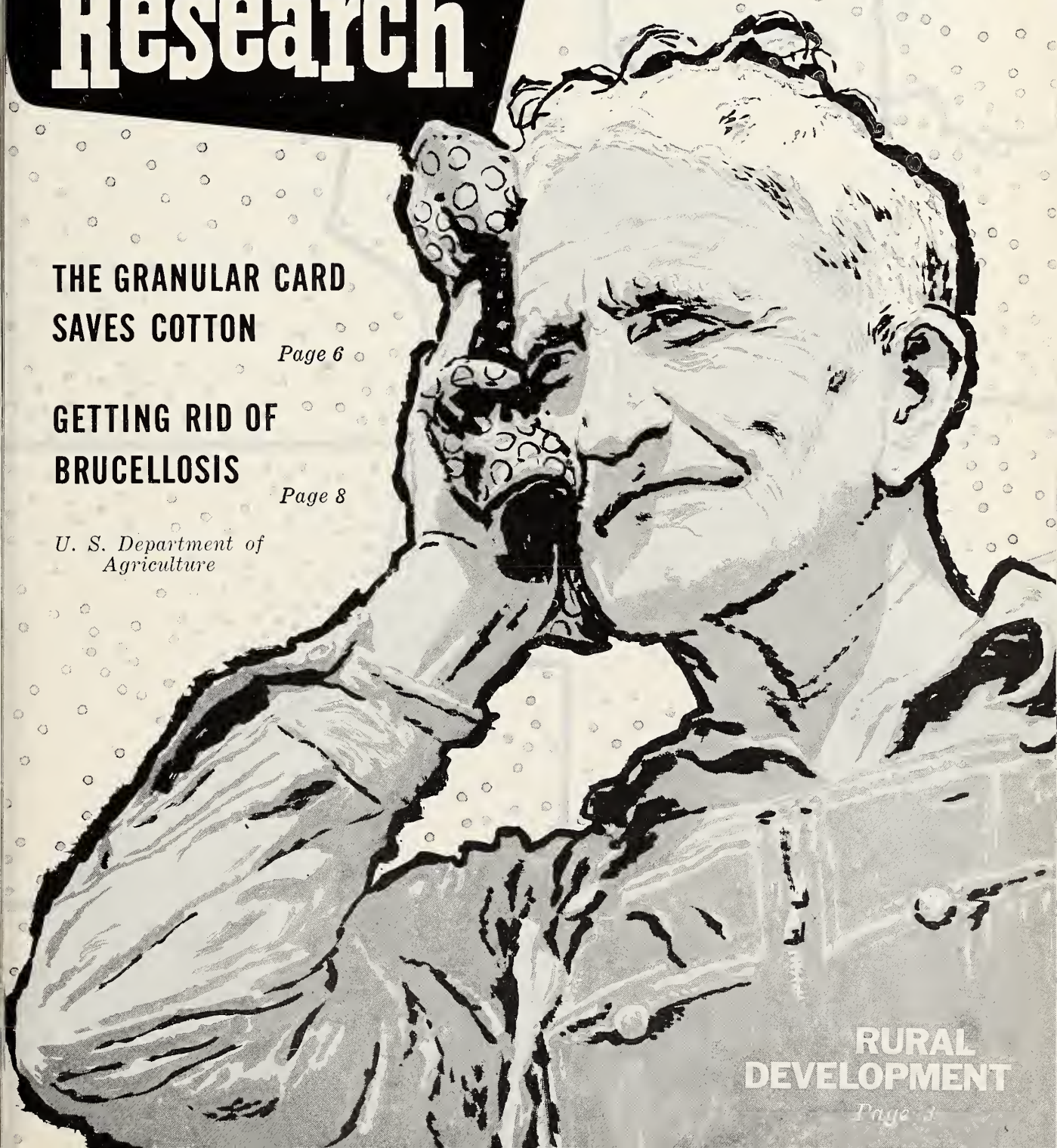
## GETTING RID OF BRUCELLOSIS

Page 8

U. S. Department of  
Agriculture

RURAL  
DEVELOPMENT

Page 3





# AGRICULTURAL Research

Vol. 7—May 1959—No. 11

## CONTENTS

Rural Development .....	3
Getting Rid of Unwanted Trees .....	12
Gibberellin Can Help Mums .....	14

### CROPS AND SOILS

The Granular Card Saves Cotton .....	6
--------------------------------------	---

### DAIRY

Milking Faster in Less Space .....	7
------------------------------------	---

### LIVESTOCK

New Tactic Against Brucellosis .....	8
--------------------------------------	---

### FRUITS AND VEGETABLES

Better Odds for Potato Breeders .....	10
Can Oil Stop Fungi? .....	11

### AGRISEARCH NOTES

Rugs That Resist Soiling .....	15
Short on Ancestors .....	15
Cochran Heads Fruit Work .....	15
New Rye Makes Good Bread .....	15
Two New Tobaccos .....	16
A Way To Cheapen Drains .....	16
Here Are Two New Grapes .....	16
Grasshoppers Thrive Here .....	16
Magazine Index Is Ready .....	16

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## Environment

What goes into creating an environment that attracts top scientists and stimulates productive research?

Important considerations include freedom to work unhindered on something significant, opportunity for personal growth, and a fair salary that increases with capacity.

How well do we in publicly supported agricultural research measure up on these points?

On salary, USDA has fallen short at times. But last year's increase puts us in position at present to compete for good talent and hold it. We also have new authority to recruit at higher levels: superior college graduates looking to advanced study can be hired at grade GS-7 (\$4980), and the Ph. D. degree qualifies scientists for grade GS-11 (\$7030).

On freedom, we have long been known as a place where a scientist can do worthwhile research and publish his findings. A retiring researcher with an outstanding record has described USDA as "second to no other institution in granting freedom for the prosecution of research and for rendering unlimited service." Our new ARS pioneering research laboratories are broadening the possibilities for satisfying work.

On opportunity, we are making progress in recognizing, promoting, and rewarding development. Here are some ways:

To get the best talent in the first place, we are searching for a method of finding whether prospects have the aptitude for successful research in the biological sciences.

We are encouraging the many USDA researchers who are stationed at land-grant institutions to take advanced work there. Further opportunity for training in needed specialties is offered by the Government Employees Training Act.

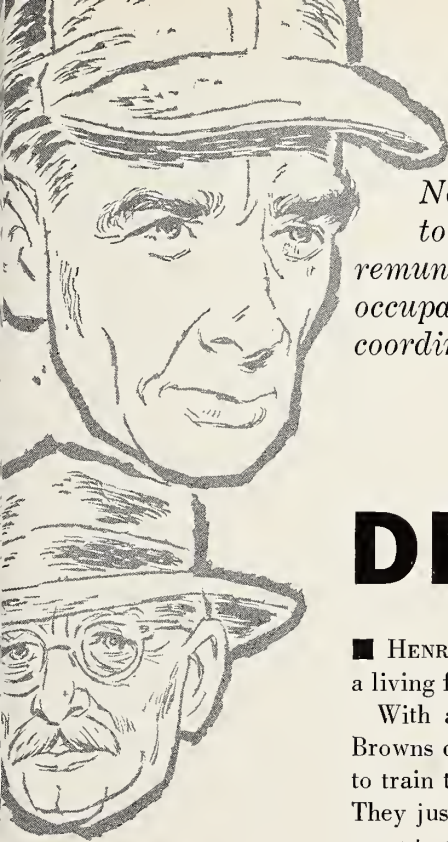
Another step is the new career plan, which provides an orderly, objective way to review our personnel to find individuals capable of rising to positions of greater responsibility.

And we are testing a new approach to setting a scientist's pay. We want to look deeper than duties or titles and measure the *man*—his creativeness, capacity, achievements.

We must have such progressive personnel management if agricultural research is to handle the job it faces.

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AGRICULTURAL RESEARCH SERVICE  
United States Department of Agriculture



*National, State and local agencies have joined to help low-income rural communities to a more remunerative combination of on-farm and off-farm occupations and a higher level of living, through a coordinated plan called*

# RURAL DEVELOPMENT

■ HENRY BROWN, 45-YEAR-OLD FARMER, his wife, and two sons eke out a living from their 75-acre Ozark farm.

With a net money income of less than \$1,000 a year, the *mythical* Browns don't spend much to help the farm produce, to fix up the house, to train the family for better earning power, or to protect family health. They just resist change, hope for the better, and watch neighbor youths move to greener pastures in the city.

Some 1.1 million *real* farm families comprising over 4 million people—one-fourth our farm population—have incomes under \$1,000. They live not only in the Ozarks but also in the South generally, the cutover areas of the Lakes States, the Spanish-American settlements of the West, the Appalachians, and elsewhere.

Since 1955, however, a major step for these chronic low-income groups has been taken with formation of the USDA Rural Development Program in over 100 counties in 30 States. The objective is to improve living standards through research, education, and community action.

Federal, State, and local committees are operating. USDA units (ARS, Agricultural Marketing Service, Soil Conservation Service, Farmers Home Administration, Forest Service, and Federal Extension Service), and other agencies participate. These include the Departments of Commerce, Labor, Interior, and Health, Education, and Welfare, the Small Business Administration, and the President's Council of Economic Advisers. State committees represent government and other agencies in agriculture, education, industry, labor, and welfare.

Workhorses of the plan—and keys to its success—are the local committees. These include people from farm, business, and civic organizations, schools, churches, and other representative community groups.

Rural Development is based on the theory that people can do things for themselves, with some leadership, and funds. The concerted nationwide effort is aimed at (1) helping acquire tools, land, and skills for families with the desire and ability to farm, (2) widening the range of off-farm job opportunities, and (3) helping rural people enjoy better training and health. Research has been emphasized in the pilot plan.





# RURAL DEVELOPMENT

(Continued)

ARS is working cooperatively with 15 agricultural experiment stations on economic studies of available resources and possible adjustment in under-developed areas. Some of these studies are shedding light on the nature and extent of resources, including labor, controlled by low-income farm families. Patterns of resource combinations and tenure and credit are being analyzed and guides set up for improving these factors. Another phase of the studies is directed at part-time farming's role in supplementing low incomes. The researchers are also trying to find why individuals differ so widely in improving productivity and income. Determinations are being made of the quantities of resources needed to produce specified levels of labor income for farm families. And we are trying to understand just how our overall attainment of a highly productive agriculture and high total farm income affects low-income families.

These studies are particularly important as a foundation for plans to provide more resources as a means to more profitable farm employment.

## Operating loans raise income

As an example of the research to aid rural-development planning, valuable basic information was obtained in a recent study of 5,555 FHA-aided families in low-income areas. It showed that families under FHA operating loans in 1947-53 had higher incomes than the area averages in 1949 as shown by the census. Where median income was less than \$1,000 in 1949, families with FHA loans earned an extra \$448 in the North, \$828 in the West, and \$397 in the South. Where median income was

\$2,000 or more, FHA families earned an extra \$1,300 in the North, \$1,750 in the West, and \$1,431 in the South. Analysis showed the advantage was due to greater resources commanded under FHA loans—not to greater previous net worth, previous farm size (as measured by sales), or to geographic or racial differences.

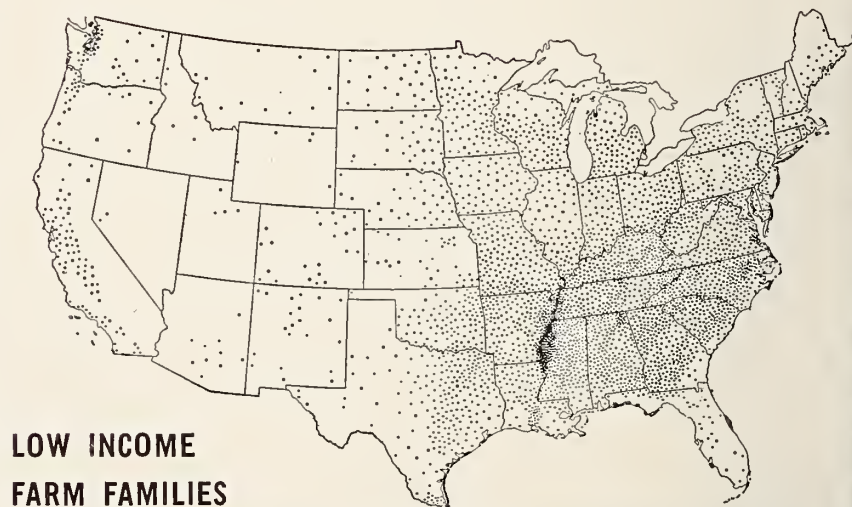
## Capital need varies by regions

Resources needed to produce specified income levels are also being studied. In South Carolina, Tennessee, Oklahoma, Wisconsin, Kansas, and Montana, a wide difference was found in the amount of capital needed. For example, to realize \$2,500 yearly, investment totaled \$14,000 for an Oklahoma cotton farm compared with \$89,000 for a Montana wheat farm. The cotton farm required only one-sixth as much initial investment, but six times as much labor investment.

None of the studies gives us all the guidance needed for increasing income level and living standards of people in low-income areas. Yet, the studies form the groundwork on which extension and demonstration activities must build. It is clear that Rural Development must offer specialized assistance for three groups. One group, the young and middle-aged able-bodied people, can work in agriculture and are considered employable by industry. The second group in their middle to advanced years, are capable of farm work, but industry won't employ them. They need better farming opportunities. Aged and infirm people, the third group, must find their improvement in limited farming. Common to all three groups is a shortage of land and capital in relation to the labor available.

## Aged, disabled are big factor

Studies in northern Florida, north eastern Texas, northern Michigan



**LOW INCOME  
FARM FAMILIES**

GEOGRAPHICAL location of our low-income farm families is shown by the map above; each dot represents 500 families with incomes under \$1,000. Many of these families are helping to better themselves through the Rural Development Program, which has improved opportunities for them, both on and off the farm. About 110 counties (right) are participating, and utilizing research results, education, and local community committees to spur action. Farm, business, and other groups are contributing leadership and financial resources. Plans are underway to extend program to about 80 more counties.

and the Ozarks of Missouri, for instance, show that aged or disabled make up a large proportion of the lowest income rural families. This means that the possibilities for increasing their earnings are slight.

### Small farm size is problem

One reason for low incomes in these areas is the small size of the farm business, causing underemployment of labor. And one of the possible solutions is to consolidate these small units or to add such intensive enterprises as poultry, dairy, or horticultural crops. In some Texas communities, this is being done. Rural Development agents have applied research findings in helping small farm operators enlarge their farms and produce commercial vegetables, and dairy and other livestock products.

The Agricultural Marketing Service is doing much research on vocational education, health, migration, indus-

trialization, and marketing related to rural development. In a study of 564 Pennsylvania high school students living on farms in 1947, only 77 females and 125 males were found on farms 10 years later, and only 67 of the men were farm operators or farm laborers. In North Carolina and Georgia, studies show that low-income farm families use health facilities and insurance sparingly and are not well aware of their availability. Cooperative surveys with the Maine, Kentucky, and Texas Agricultural Experiment Stations showed 7 out of 10 farmers are eligible for Old Age and Survivors Disability Insurance. The farmers generally support this insurance, but many farmers there could benefit by more information.

Local committees have explored the possibilities for increasing employment and have already helped create about 1,800 additional jobs in rural industries and new agricultural

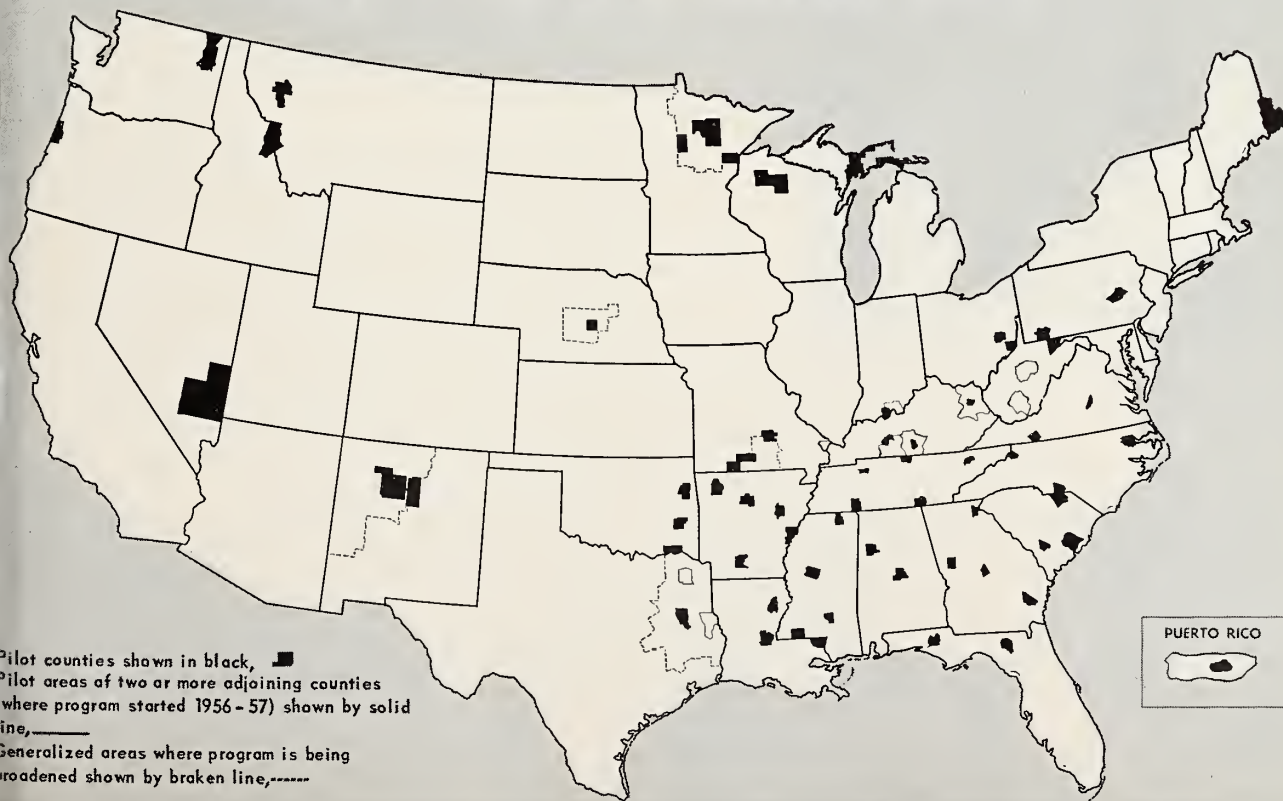
enterprises in 24 demonstration counties. Job opportunities are being expanded mainly through establishing or expanding manufacturing facilities where research has shown the need and the potential. Employment guidance and training to improve the skills of rural people are also helping.

### Local groups help find jobs

Resource and manpower studies in South Carolina helped program and business leaders promote industry and bring 200 new jobs to one county.

Rural Development in West Virginia is complicated by the large amount of industrial unemployment. Low-income rural people have little opportunity to shift with the non-farm work. Unemployed and partially employed miners are starting a little farming or gardening to supplement incomes. This is a special situation in which industrial redevelopment is the major consideration.★

## RURAL DEVELOPMENT PROGRAM 1958-59





# The Granular Card SAVES COTTON

*Processing machine with a simple, durable new part has demonstrated in pilot and mill tests that it reduces waste and produces cleaner lint*

■ AN IMPROVED DEVICE for a carding machine promises to save the textile industry millions of dollars a year. Developed through USDA research, the device cuts cotton carding waste by more than half.

The innovation is a semicylindrical housing—granular on the inside surface—that covers the rotating cylinder and provides friction against the passing fibers. The device was developed by engineers R. A. Rusca, R. S. Brown, and A. L. Miller at the ARS Southern utilization division, New Orleans. It replaces an elaborate assembly of moving parts called “flats” on present-day carding machines.

Machines equipped with this feature are called granular cards and represent a further contribution of USDA's continuing research toward improving the competitive position of cotton in the textile market.

The carding attachment has no moving parts. It weighs about 200 pounds, compared with nearly 1,000 pounds for the flats it replaces. With the attachment in place, the carding machine is completely sealed, thus eliminating a major source of dust in textile mills. Upkeep of this

machine is low, since only one part of the attachment is subject to wear.

Although simple, the granular housing must be machined precisely, according to Rusca. A public-service patent has been allowed and is available for licensing.

In pilot tests at New Orleans on six types of cotton ( $31\frac{1}{32}$  to  $17\frac{1}{16}$  inches in staple lengths) from three growing areas, waste averaged 2.63 percent of the carded cotton from the granular card and 5.81 percent from the standard flats card. The two carding machines produced carded cotton of comparable quality and uniformity.

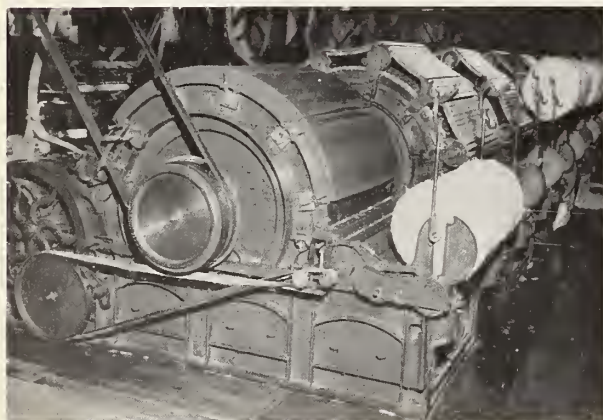
Limited mill-scale tests were started last August with cotton of  $11\frac{1}{16}$ -inch staple length of strict-middling grade. The granular card reduced waste by 4 percent of the cotton carded. That is more than was saved in the pilot plant trials with similar cotton. The mill-scale tests also showed that slightly fewer neps (tiny knots of fibers) were produced and that yarn quality was maintained by the granular as compared with the conventional card. More expensive mill evaluations are in progress.

## Air currents, granular surface loosen fibers

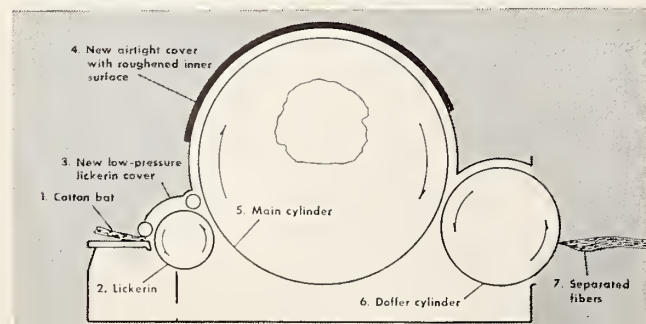
The granular card resulted from a 2-year study of air currents in carding machines. These studies demonstrated that carding in present-day machines is essentially a mechanical action. However, the air currents in the card, properly directed, can be made to assist in separating the cotton tufts into their individual fibers. The granular card combines the effect of air currents and specially prepared inner surface next to the carding cylinder to carry out efficient operation.

Investigation of air currents within carding machine also led to development of a new type of cover for the lickerin—the tooth-covered roller that feeds tufts from cotton bats (not the bats themselves) into the carding machine. Although not necessary to the granular card operation, the lickerin cover does materially reduce air currents and fiber loss.

Strangely enough, this return to a carding machine without moving flats reverses textile history. Flats were stationary until about three-quarters of a century ago just as the granular housing is stationary. The stationary flats, however, gave much trouble, including the necessity of cleaning them many times a day. ☆



HOUSING with a granular undersurface (on machine at left) is simpler, more efficient and durable than standard moving band of flats on machines at rear. Diagram shows elements of new card.





New stall arrangement lets milker handle about twice as many cows in usual time

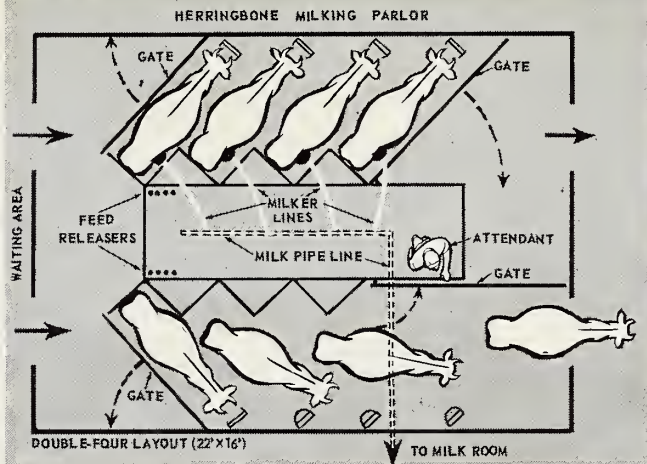
## MILKING FASTER IN LESS SPACE

■ HERRINGBONE MILKING parlors—aid out in the familiar weave pattern—are a fast-spreading innovation that fits more cows into less space.

The closer quarters in the unique herringbone layout cut down operator movements and greatly speed milking. Integrating this layout with pipeline milking and bulk-tank systems makes maximum use of dairy equipment and enables an operator to milk more cows or do more chores.

About 1,500 dairies in this country have adopted or are installing the herringbone milking parlor, introduced from New Zealand in 1957. USDA-State farm economists and engineers surveyed 18 eastern and midwestern States and found that dairymen using the herringbone layout about doubled the number of cows handled per hour. This takes no more space than do conventional two-sided milking parlors with cows in tandem in stalls parallel to a center work pit.

Herringbone layouts save space by placing cows in two rows along opposite walls and angled outward at about 30°—as in the herringbone weave. A pit working area down the center separates the rows. Each cow stands snugly against her neighbor, head toward the outer wall. The cow, positioned at an angle, juts her rump just beyond the neighbor's. This makes udders readily accessible and gives the operator space for chores.



**HERRINGBONE** milking parlor can fit cows into less space than conventional stall layout by angling cows snugly along either side of work pit. Operator saves time and can milk more cows a day by handling each side in groups and by cross-milking in the closer quarters.

Cows are alternately let into each side of the parlor in groups through mechanically operated doors controlled by the operator in the pit. And while cows on one side are being milked, the operator lets in a group on the other side and prepares them for milking. Thus milking is continuous, increasing milking rates and making fuller use of equipment. Handling cows in groups greatly reduces let-in and turn-out time.

### Layout relieves a bottleneck

Despite the labor-saving revolution in agriculture, dairying continues to require a lot of labor at the milking stage. It still takes manpower to move cows in and out of the milking parlor, prepare them for milking, attach milking cups, operate feeding devices, and clean up. Increasing milk output on dairy farms in recent years has accentuated this bottleneck. ARS agricultural economist M. M. Lindsey, who studied milking efficiency in 51 herringbone milking parlors in the East, Southeast, and Midwest, concludes that the layout permits near-capacity operation of pipeline milkers, bulk tanks, and overhead automatic feeders. There is little or no dead time during milking.

In a double-four herringbone—2 rows of 4 stalls each—a single operator can handle about 40 cows an hour and still have time to take care

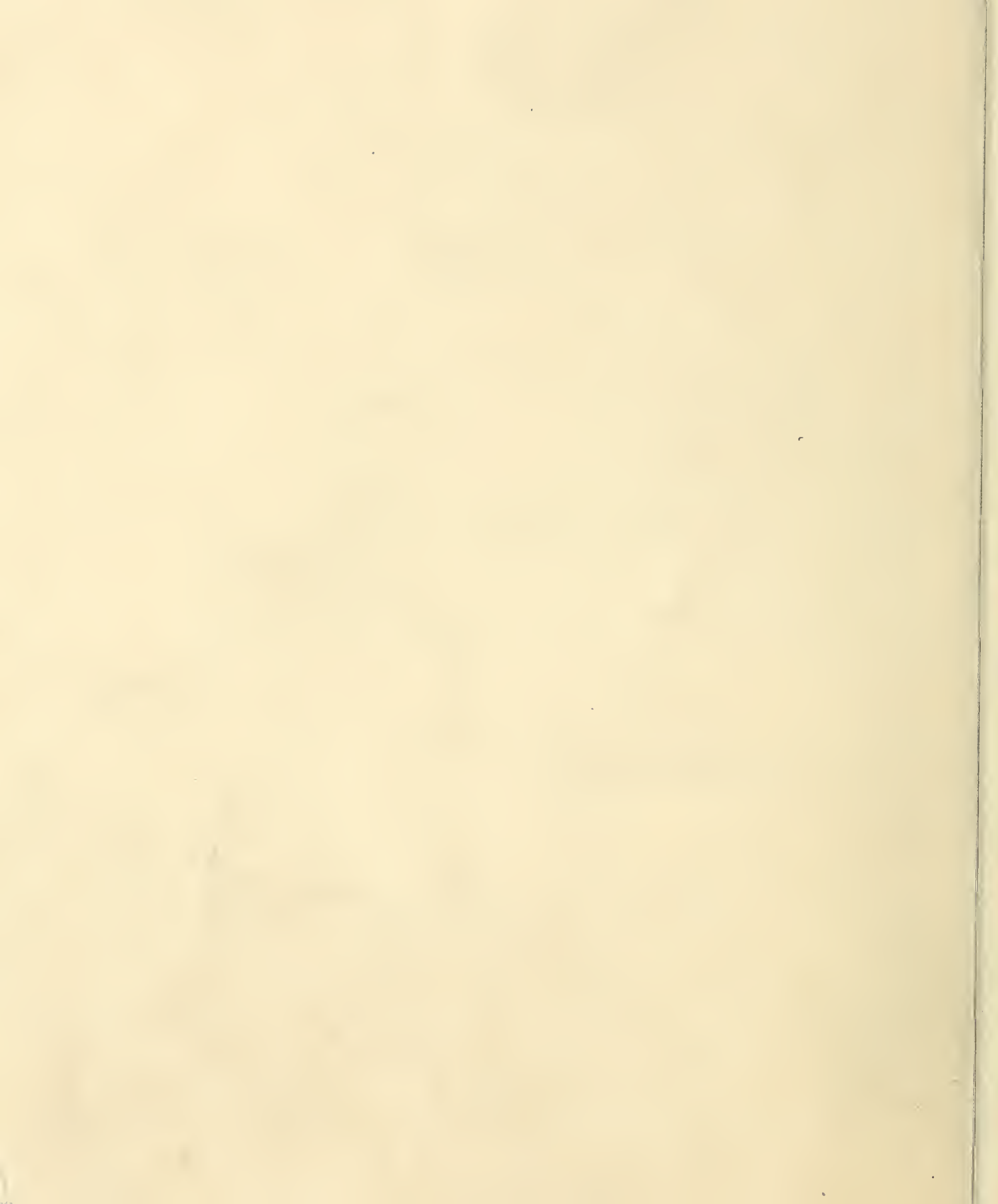
of emergencies. Lindsey reports that one operator can handle 50 to 60 cows an hour in a double-six layout, but he has little or no idle time and risks over-milking by leaving the machine on a milked-out cow.

An operator can milk much faster in the herringbone layout than in conventional parlors or stanchion barns because he makes fewer movements in handling the closely spaced cows. Udders of adjoining cows are separated by an average of slightly over 3 feet, compared with 8½ feet in conventional parlors. The greatly reduced time to let cows in and out also speeds the milking operation.

A herringbone layout large enough to milk 12 cows at a time uses the same type equipment in about the same total space as a conventional milking parlor to accommodate 4 cows. Building costs and costs per stall are about the same for the two systems, so total cost of any parlor will depend on the number of stalls.

### New equipment is on the market

Several manufacturers offer herringbone-type equipment and, in some cases, include the building in a package deal. One double-six prefabricated unit is advertised to sell for \$7,600. ARS agricultural engineers are preparing herringbone-layout plans, to be available later this year from State extension offices.★





*Tagging range cattle as they go to market and sampling blood as a routine during slaughtering offer simpler means of tracing costly brucellosis and hope for rapid gain against the disease*

# NEW TACTIC AGAINST brucellosis

6. NEW traceback system means disease can be wiped out in infected herds, and results applied toward area recertification.

1. PLASTIC tags—thin, tough, pliable—are placed on animals as they move out from ranch to market. Cooperating States will work out own tagging.

5. STATE office identifies county and herd of origin of reactors and notifies owners. Officials and owners will work to eliminate disease.

4. OFFICIALS AT the nearest State-Federal laboratory check tagged blood samples for brucellosis. Results are sent back to State of origin.

3. ROUTINE blood samples are taken from each tagged cow in slaughterhouse. Procedures will be developed cooperatively to meet individual situations.

2. ANIMALS reach a stockyard still bearing tags showing the State, county, and herd of origin. Buyer selects, sends cattle to slaughterhouse.

■ ULTIMATE ERADICATION of brucellosis will become a brighter prospect if new plans—already successful in limited trials—can be made to succeed when available to the 17 western cattle States this summer.

USDA in cooperation with the States is initiating services that could lead to a simpler method of maintaining modified-certified-brucellosis-area status, based on blood testing of dry and cull cows on the way to or during commercial slaughter. But this depends on industry providing the means for adequate traceback. As contemplated, the animals to be shipped will be identified by tags showing State, county, and herd of origin. This will provide the means for routine retesting as required for recertification. When blood tests reveal reactors, it will then be possible to trace and eliminate the infection in herds of origin.

Trials for the past 3 years in eight States showed that slaughterhouse testing of dry and cull cows effectively discloses the brucellosis status of a range area and that the chosen coding system is the most practical of several satisfactory ones tried.

The U.S. Livestock Sanitary Association—composed of representatives of all the livestock sanitary officials and segments of the livestock industry—and the ARS Animal Disease Eradication Division have approved the plan for applying the results of dry-cow and cull-cow testing to area recertification.

## Necessary vigilance is provided

This is how the recertification plan works:

When blood testing for 3 years representing at least 15 percent of the breeding cows in a particular range area shows that not more than 1 percent of the animals and 5 percent of the herds have brucellosis, that area can be recertified for 3 years. Other requirements to be met include vaccination of heifer calves and semiannual milk-ring testing of all dairy herds. Of course, when slaughterhouse blood tests reveal reactors, State-Federal officials will assist owners by helping to free their herds of brucellosis. The method thus provides constant vigilance on the brucellosis status of a range area.

Individual States will work out details of their own

procedures but, in general, tagging is to be done by ranchers or other designated persons as cattle move from ranch to market. The thin, pliable plastic tag will be glued over an animal's ribs and must "stay put" long enough for the animal to reach the most distant market.

The blood-collection procedures will be worked out cooperatively by local, State, and Federal officials and with individual plant managements to meet each slaughterhouse situation. Recognizing that some changes may be necessary, the regulatory officials feel the entire collection procedure should remain quite simple.

Cooperation of range cattlemen will be a major factor in the success of this plan. The range cattle industry has long urged the USDA to develop a plan for recertification that would be less bothersome to them.

## Recertification should be easier process

For several years, the dairy industry has had the advantage of the milk ring test as an inexpensive and convenient method for screening herds for brucellosis. The beef cattlemen have had no method of comparable sim-

plicity, but it is now hoped that the cull and dry cow testing plan will provide them with advantages similar to those now enjoyed by the dairy industry.

Trends in herd-management practices—the wider movement of breeding animals, coupled with the broadening of markets for breeding cattle—emphasize the desirability of eliminating brucellosis in range areas. Acquiring and maintaining modified-certified-brucellosis-area status, and applying methods such as the newly designed plan of recertifying range areas, are aimed at eventual eradication of the disease.

## Ultimate eradication seems more likely

Just as the widely recognized milk ring test became a vital tool for eradication of brucellosis in dairy herds, so slaughterhouse testing of dry and cull cows can become a major tool for eradicating the disease in range herds. With early detection of brucellosis-infected herds and cooperative effort in eradication, we can look forward to the time when this crippling disease will no longer be a threat to the livestock industry.☆



# Better ODDS for Potato Breeders

**Locating plants with half the normal chromosome number opens way for more efficient crossing with wild species having desirable characters**

■ EXPERIMENTAL HAPLOIDS are being used in a breeding technique to give our commercial potatoes desirable horticultural qualities from genetically unlike relatives.

A haploid (fatherless plant) has half the normal chromosome number of its species and, so far as we have known, occurs only by chance. But geneticists have learned how to detect haploids as they occur and make good use of them to improve potatoes.

Many wild and cultivated tuber-bearing species of the genus *Solanum* have desirable horticultural traits. But until now, certain genetic incompatibilities have kept us from using this potential breeding stock to the fullest to improve our commercial potatoes. The trouble is that chromosome numbers in the various *Solanum* species range from 24 to 72. Our commercial potatoes, which are members of the species *S. tuberosum*, are tetraploids with 48 chromosomes, while most wild species are diploids with 24. The hybrids obtained be-

tween tetraploid *S. tuberosum* and the diploid wild species have been triploids and were essentially all sterile.

Having haploids of our commercial potatoes, on the other hand, enables us to combine much more readily the genetic characters of these normally tetraploid plants with wild species.

## Technique uses marker genes

ARS geneticists R. W. Hougas and S. J. Peloquin, working cooperatively with Wisconsin Agricultural Experiment Station, perfected a technique of using marker genes in breeding stocks to disclose naturally occurring haploids. By mating diploid species with closely related but tetraploid *S. tuberosum*, the researchers got a few haploid seeds borne on the tetraploid parent. The few probably arose from unfertilized egg cells following the interspecific mating.

Haploid plants from these seeds are smaller and less vigorous than their parents, and leaflets are small and narrow, compared with *S. tubero-*

*sum*'s large, broad ones. But a full set of characters from the parent's 48 chromosomes is contained in the haploid's 24 chromosomes. That's the number for crossing with most wild species, which have 2 sets of 12.

Once they have made the hybrids between wild diploids (with 24 chromosomes) and the new experimental *S. tuberosum* haploids (with 24 chromosomes), geneticists can use the drug colchicine to double the chromosome number of the promising interspecific hybrids to 48. The doubling would permit crosses between these new stocks and commercial tetraploids.

## More haploids must be studied

Research with haploids is still preliminary, and many more chance offspring will be needed to thoroughly test this technique of potato improvement. From further experiments with the offspring, scientists will be able to determine how useful haploids are in transferring specific genes from

**POLLEN** from wild diploid species *Solanum phureja* generally fails to produce seed on tetraploid Katahdin variety but did result in triploid (left) and fatherless haploid (right).



HAPLOID potatoes' leaves vary greatly in size and form but generally are smaller and less stocky than the leaves of normal tetraploid potatoes. Leaves here from two haploid plants contrast with tetraploid Katahdin leaf at center.



wild diploid species to cultivated tetraploid potatoes.

Success with haploid research would give our scientists some major advantages in breeding superior commercial potatoes. The diploid inheritance ratios are much simpler than those of tetraploids and would, in turn, simplify our studies of inheritance of potato traits.

### Simpler gene pattern helps

In crossing two diploid lines that are both heterozygous—that is, not pure breeding for a particular character—the progeny collectively have a dominant trait three times as often as the contrasting recessive gene, or in a 3 to 1 ratio. But in crossing two heterozygous tetraploid potatoes of similar genetic makeup, this inheritance ratio often becomes 35 to 1 and occasionally much higher. Plant breeders may have to produce very large populations from tetraploids in order to obtain plants with a desirable recessive trait in combination with other acceptable traits.

By using haploids, scientists may also be able to develop triploids, tetraploids, and pentaploids—that is, with three, four, and five sets of chromosomes—and compare the productivity of these new lines with normal tetraploid potatoes. Potatoes at one of these new ploidy levels may prove to be far more productive than any we can produce by crossing our present commercial potatoes.

### Quicker results are expected

An accelerated breeding effort is another advantage from haploids. White potatoes that breed true for a desirable trait can be developed in far less time using the new diploids than is possible with tetraploids. One generation of selfing in a diploid is equivalent to four or five generations in a tetraploid. That's why the breakthrough with haploids, though still young, gives us so much hope. ☆



MINERAL OIL spray on  
left half of banana leaf controls  
disease; right half was untreated.

## Can Oil Stop Fungi?

■ SCIENTISTS ARE PUZZLED by commercial banana growers' success in controlling Sigatoka leaf-spot disease of bananas by an unusual method—spraying with oil. Although oil sprays are widely used for insect control, this is the only plant disease now controlled in this way.

A curious fact is that oil apparently doesn't attack the fungus directly. In fact, scientists at the Federal Experiment Station, Mayaguez, P.R., found that the fungus grew well in oil culture and on oil-coated leaves. Oil inhibits the fungus only after it enters the leaf.

Plant pathologist L. Calpouzos and his associates, T. Theis, C. Rivera, and C. Colberg, believe the oil may have a unique mode of antifungal action. While studying the development of the fungus (*Mycosphaerella musicola*) on leaves and in culture, the researchers found that the oil had no significant effect on mycelial growth, germination of conidia and ascospores, penetration of germ tubes into leaves, ascospore discharge, or conidial spore formation. Growth of the fungus was arrested at only one stage in its life cycle—after the organism entered the leaves but before disease symptoms appeared.

The tests were made with two petroleum spray oils similar to those used on various crops for insect control, as well as with a pharmaceutical mineral oil, and a chemically inert silicone (a synthetic oil). Effectiveness of the latter suggests the oils act on a physical rather than chemical basis. The exact mechanism of control, however, is not yet understood. The scientists are trying to learn how and where the fungus development is arrested inside the banana leaf.

For control of the leaf-spot disease of bananas, the oil is applied in pure form as a mist at the rate of 1 to 3 gallons per acre.

The Puerto Rican researchers are now studying the possibility of controlling a variety of leaf diseases in the same way. ☆



*Experiments on a number of forests are giving us much valuable information on best chemicals and methods of application to use in getting rid of species that need to be eliminated for betterment of our timber stands*



PINE SEEDED IN and took over after low-value oaks in Kisatchie National Forest, La., were killed by girdling.

## Getting Rid of Unwanted Trees

■ ALTHOUGH CHEMICALS HAVE LONG been used to get rid of cull trees and other undesirable forest vegetation, more information has been needed about which treatments, dosages, and chemicals are best. Now research by USDA's Forest Service and ARS is supplying some of the answers for individual species and local conditions.

At the Bent Creek Experimental Forest near Asheville, N.C., for example, foresters applied chemicals in various ways to red maple, sourwood, laurel, rhododendron, oaks, and hickories. Three growing seasons later, it was ap-

parent that no one treatment was effective on all species and all sizes.

Rhododendron and red maple were the most difficult to kill—indeed, large maples did not respond well to any treatment. Small maples and laurel died when thoroughly wetted around the base with 2,4,5-T in fuel oil. Best control for rhododendron was to cut it down and treat the stumps with 2,4,5-T in oil.

Ammate crystals were best on sourwood—applied on cut stumps of small trees or in ax-made cups at the base

### Treatments used on trees smaller than 5 inches in diameter

1. Base of tree was thoroughly wetted with low-volatile butyl ester of 2,4,5-T in fuel oil. This method killed many species of less than 5 inches diameter.

2. Trees of less than 5 inches diameter, cut but not chemically treated, often sprouted. This made it necessary to follow up with additional controls.

3. Stumps of small trees were thoroughly wetted with 2,4,5-T in oil. This treatment was especially effective on hickory and rhododendron.

4. Ammate crystals proved highly effective when applied to freshly cut stumps of small sourwood and hickory. Crystals gave good sprout control in oak.





of medium-size trees. Small hickories were controlled by treating stumps with 2,4,5-T in oil; medium-sized ones by placing the chemical in ax frills (cuts) around trees; and large ones by ax-girdling without a chemical. Oaks gave a similar response to ammate crystals.

### Treatment techniques and site affect results

Site had some effect. Sprouting was more profuse on slopes at 3,000 feet than on flat areas 2,500 feet in elevation, but it is not known whether this was due to elevation, slope, aspect, soil, precipitation, or time the treatment was applied.

Work on killing beech trees at the Bluff Experimental Forest near Vicksburg, Miss., showed that the frill or girdle must extend completely around the tree. Any unsevered cambium may allow survival, even though a chemical is poured into the cut.

Diesel oil is more effective than water as a carrier for 2,4,5-T, a study in the Ouachita Mountains of Arkansas showed. Crowns died on 98 percent of the white oaks injected with the chemical in oil. In water, the chemical gave a 65-percent kill.

To determine the amount of 2,4,5-T in oil needed to prevent or reduce the sprouting of cut birch, beech, and black cherry, foresters treated stubs in a mowed strip on the Kane Experimental Forest in Elk County, Pa. Sweet and yellow birch died from cutting alone. Black cherry took twice as much 2,4,5-T to eliminate sprouting as beech did. Saplings standing on the strip edge were more resistant to treatment than stubs.

There was some translocation of chemical between treated and adjacent untreated beech root suckers, probably because the suckers may have originated from the same root. Maximum distance of such killing by translocation was about 6 feet.

Cutting or girdling and applying chemicals by hand

are costly. Where the species to be preserved is tolerant of the chemical, it is possible to spray foliage of unwanted vegetation from either the ground or air after leaves have developed.

On the Columbia Forest Research Center in Missouri, researchers sprayed aerially a stand where low-quality oak was holding back desirable shortleaf pine. Solutions of 2,4,5-T or 2,4,5-T acid in oil were used. The oaks lost 90 percent of their leaves the first season and about half died after 2 years. No pine trees were killed, new needles replaced those lost the same growing season, and the trees recovered with no apparent adverse effect on form or vigor. Released pines grew 50 percent more during the second growing season than similar unreleased pines. Aerial spraying costs averaged \$7.75 per acre on 40 acres and \$4.92 per acre for 800 acres. (Cost per acre is less when large areas are sprayed.) Comparable release by hand methods would have cost from \$12.50 to \$25 per acre.

### Aerial spraying is effective on some trees

In cooperative studies with Louisiana State University, aerial spraying with 2 pounds per acre of butoxyethanol-ester of 2,4,5-T in an oil-water emulsion killed over 90 percent of tops of sweetgum, post oak, and blackjack oak. Root sprouting was negligible. Water oak and red maple were hard to kill, as at Bent Creek. Pine suffered relatively little, and only for the first year. This spray killed all stem sizes of a susceptible species. It cost \$7.50 to \$9 per acre, applied.

Cull and weed trees are a problem in many States. The Forest Service estimates that trees of little or no value make up one-fifth of New Jersey's forests, one-fourth of Mississippi's, and one-eighth of North Carolina's. Better techniques for eradicating culls will help insure adequate lumber for the future.☆

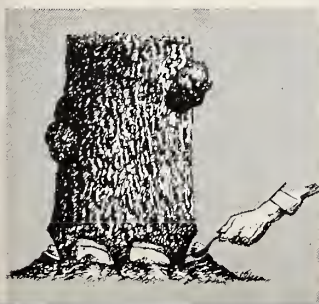
## Treatments used on trees larger than 5 inches in diameter

1. Cups made with ax in base of trees were filled with ammate crystals. This gave good crown kill and prevented sprouting of medium-sized oaks, sourwood.

2. Notch girdle was made around tree by removing bark with ax. No chemicals were used. This was effective on hardwoods over 12 inches in diameter.

3. Machine-girdling killed oak and hickory, although some hickories bridged over the cut. This method was used with and without 2,4,5-T in oil.

4. Frills around tree completely severed cambium layer. Filling with 2,4,5-T in oil gave better kill than chemical in water or water and wetting agent.



Timely application  
of this chemical to  
spray-type mums will  
cause blossom stalks  
to elongate, thus  
spreading blooms  
and improving the  
display effect of  
the cut flowers



THREE PLANTS of chrysanthemum variety Shasta are the same age. Growers' usual daylength control lengthened blossom stalks but delayed bloom of plant at right. Center plant, treated with gibberellin, has long blossom stalks but blooms at same time as untreated plant at left.

## GIBBERELLIN Can Help MUMS

■ IT'S AN OLD AXIOM that a blossom stalk is just long enough to reach from the bloom to the plant stem. Chrysanthemum growers, however, find that they need a little more length for spray-type cut flowers than is normally produced by the plant.

Commercial mum growers have been using a complicated method of day-length control that stretches blossom stalks (peduncles) but also makes the plant bloom later.

Now researchers at USDA's Agricultural Research Center, Beltsville, Md., have found that treating mums with the growth-stimulating chemical gibberellin at just the right time lengthens blossom stalks within the normal growing period.

Gibberellin is best known for its *general* lengthening effect on plants. The new *specialized* use of gibberellin, however, doesn't lengthen and thus weaken the main plant stem.

The new method is usable not only in greenhouses, but also in home

gardens to improve floral displays.

The general rule evolved by ARS horticulturist H. M. Cathey and physiologist N. W. Stuart after studies on different varieties is to spray the flower buds, growing tip, and leaves just below the tip as soon as the flower buds are visible. The spray is repeated 5 days later. The solution—50 parts per million of gibberellin—is applied until it starts to run off the leaves.

Cathey and Stuart also found that treating the flower buds with the gibberellin solution once a week from the time the buds are visible until color shows hastens flowering.

### Spray offsets poor conditions

This treatment can counteract flowering delay caused by unfavorable night temperatures. In greenhouses where other plants are grown, night temperatures may be above or below the optimum (60° F.) for flowering of mums. Black cloth cov-

ers used to shorten the day and induce flowering of mums may raise temperatures. Home gardeners, who have no control over temperature, may also find gibberellin helpful.

### Commercial method is shortened

The gibberellin method of stretching blossom stalks should simplify part of the commercial process of growing these fall-blooming plants and forcing bloom out of season. After mums are exposed to long days for vegetative growth, greenhouse men routinely put them on short days until flower buds begin to form. At this point, growers wanting better floral displays have been restoring long days—at the expense of flower development—to make stalks elongate, then repeating the short-day treatment to complete blooming. The gibberellin treatments, which are made after the flower buds are formed and visible, would eliminate the latter two steps and delay in blooming. ☆



## Rugs that resist soiling

Do soil-retardant finishes help protect cotton floor coverings from soiling? Researchers in USDA's Institute of Home Economics found that they are helpful if applied after each cleaning. Rugs without finishes picked up soil faster and more of it than treated ones.

Samples of cotton pile broadloom in white, pink, green, and gray treated with three different kinds of soil retardants were put on a cafeteria floor where all the customers would walk over them. After 2 days the rugs were washed—half of them in a large wash wheel and tumbler dried, the other half by reciprocating brush and air dried. One of each finish from each group and color was re-treated and all the rugs were again put on the floor. This procedure was repeated six times.

All three finishes studied were equally effective in retarding soiling of rugs. Untreated rugs soiled on an average of 1.6 times faster than treated ones. All of the retardants took away some of the softness of the rugs. One retardant yellowed



them slightly and two gave a slightly chalky appearance to pink, green, and gray rugs.

Rugs washed by the reciprocating brush method shrank less and kept their color better, but those in the wash wheel were washed cleaner.

## Short on ancestors

The first turkey poults ever sired by a male turkey of known partheno-

genetic origin have hatched and are growing normally at USDA's research center at Beltsville, Md.

The poults, which have no paternal grandfather, are another development in the long-range basic study of fertility and hatchability in chickens and turkeys being conducted by ARS poultry husbandman M. W. Olsen (AGR. RES., Aug. 1953, p. 4; Nov. 1954, p. 3; June 1956, p. 3; Nov. 1957, p. 3). These studies also contribute to a better understanding of chromosomes and cell growth in all forms of life.

The sire of the poults is one of 20 parthenogenetic male birds hatched in the spring and fall of 1958. Five of the 20 grew to maturity, but thus far only 1 has produced viable spermatozoa. The spermatozoa were used to artificially inseminate virgin turkey hens, and fertile eggs were produced. There are now about 37 poults in the flock.

## Cochran heads fruit work

L. C. Cochran became Chief of the ARS Fruit and Nut Crops Research Branch, with headquarters at Beltsville, Md., April 1, succeeding J. R. Magness, who retired after nearly 40 years service with USDA.

Magness, an international authority on horticulture, will continue as collaborator, advising ARS on horticultural research. On July 1, he will also become editor of the Proceedings of the American Society for Horticultural Science.

Cochran has been with USDA since 1941. For 16 years he supervised virus studies on deciduous fruits at Riverside, Calif., and since 1957 headed production research on citrus and subtropical fruit crops at Orlando, Fla. Previously, he studied

virus diseases of citrus for the California Agricultural Experiment Station. He is well known for his work on peach mosaic and virus diseases of deciduous tree fruits generally.

## New rye makes good bread

Bread made from Tetra Petkus rye—new tetraploid German variety introduced here 10 years ago—has better, stronger flavor than breads from other ryes. USDA tests show.

ARS baking technologist C. C. Field and agronomist L. P. Reitz compared the milling and baking qualities of Tetra Petkus grown in Wisconsin and Pennsylvania with qualities of five diploid varieties—Imperial, Caribou, Adams, Balbo, and Von Rumker—grown under similar conditions.

Tetra Petkus milled satisfactorily, producing a good yield of flour. It was similar to standard flours in color, feel, granulation, and ash content, slightly higher in protein, and had greater activity of alpha amylase and diastase enzymes. Tetra Petkus flour appears to be slightly better in mixing tolerance and somewhat stronger in general physical dough properties. However, the dough was very sticky, difficult to handle, and generally inferior to doughs of diploid rye flours.

Tetra Petkus was developed by treating diploid Petkus with colchi-



cine to double the number of chromosomes. The resulting coarse, vigorous plant stands up better on rich soils but matures later than diploids. Tetra Petkus is susceptible to mildew, leaf rust, and soil-borne mosaic. The

## AGRISEARCH NOTES · AGRISEA

seed is about double the size of ordinary rye, posing a problem in cleaning before milling. Standard equipment cleans ordinary rye but discards oversize objects.

### Two new tobaccos

S.C. 58 and N.C. 73, new flue-cured tobacco varieties highly resistant to black-shank disease, have been released jointly by USDA and the North and South Carolina Agricultural Experiment Stations for the Atlantic Coast States. USDA and the State stations do *not* have seed for distribution. S.C. 58 seed is available from the South Carolina Crop Improvement Association at Clemson, and N.C. 73 from 15 certified seed growers in the Carolinas.

### A way to cheapen drains

Right-angle tile joints for connecting laterals to main drainage lines performed as well in USDA-Minnesota Agricultural Experiment Station tests as did the 45° junctions usually recommended for drainage systems.

Using the 90° joints could considerably reduce the cost of installing hundreds of millions of feet of drain tile on farms each year. The 45° junctions take more hand labor and installation expense and, because of fitting problems, often give poor connections. Laterals generally have to be curved to connect with the main line at that angle.

The two junctions were compared

in model systems made of small tile and fittings at the St. Anthony Falls Hydraulic Laboratory, Minneapolis.



Previous work showed that model systems get about the same results as normal-sized systems.

Other angles from 15° to 165° had no advantage over 90° in the tests.

### Here are two new grapes

Two new grape varieties developed by USDA plant breeders are ready for propagation by fruit growers and nurserymen. Exotic, a vinifera variety, is recommended for Arizona. Magoon, named for the late Dr. C. A. Magoon, former head of USDA grape research, is suited to the Gulf States.

Exotic is a vigorous, productive variety with large clusters of firm, medium-large, nearly-black, crisp berries of good eating quality. Exotic ripens about a week after Cardinal. Shipping quality and market acceptance are good. The blossoms are self-fertile. Exotic is being tested for possible value in California.

Fine-flavored Magoon is a productive, vigorous, perfect-flowered muscadine that may be planted alone or as a pollinizer for male-sterile varieties. Magoon has medium-sized reddish-purple grapes ripening in early midseason—about Sept. 7 at Meridian

Miss. It has done particularly well in central and southern parts of the Gulf States and Georgia.

USDA has no vines of Exotic or Magoon for distribution. Information on sources of cuttings of Exotic is available from the U.S. Horticultural Field Station, Fresno 2, Calif. Information on Magoon may be obtained from the U.S. Horticultural Field Station, Meridian, Miss.

### Grasshoppers thrive here

Grasshopper numbers in alfalfa in Arizona's warm southern valleys increase as the stands become older, USDA entomologists found in a survey of the Salt River Valley. They also found more grasshoppers on weedy fields than on clean fields.

Since plowing up the alfalfa and planting cotton or another cultivated crop reduces grasshopper populations drastically, the entomologists suggest frequent rotation of alfalfa and cotton, and weed control.

### Magazine index is ready

First section of an index for AGRICULTURAL RESEARCH has gone to press. It covers the first three volumes—from January 1953 through June 1955.

If you need a copy of this index, please address a postcard to Publications Distribution, Information Division, Agricultural Research Service, U.S. Department of Agriculture, Washington 25, D.C.